An Extract of the Journal Des Scavans. *of* April 22 *ſt. N.* 1686. *Giving an account of two new* Satellites *of* Saturn, *diſcovered lately by Mr.* Caſſini *at the Royal Obſervatory at* Paris.

THe Variety of wonderful Diſcoveries, which have been made this Century in the Heavens, ſince the invention of the *Teleſcope*, and the great Utility that may poſſibly be drawn therefrom, for perfecting natural Knowledg, and the Arts neceſſary to the Commerce and Society of Mankind, has incited Aſtronomers more ſtrictly to Examine, if there were not yet ſomething conſiderable, that had not been hitherto perceived.

The diligence of thoſe that have gon before, having left only the moſt difficult and obſure Objects to diſcover, theſe *Satellites* of *Saturn* which are eminently ſo, by reaſon of their Smallneſs and great Diſtance from the Sun and Earth, have fallen to the ſhare of *Sign. Caſſini*; who being furniſhed with *Teleſcopes* of an extraordinary length and goodneſs, has been able to ſee deeper into the Heavens, than thoſe that have hitherto attempted. Mr. *Hugens* indeed found out one of them, *viz.* the fourth and biggeſt about thirty Years ſince, and made out the Theory of the *Ring* or *Anſæ* of *Saturn* till then unknown; but it ſeems there remained yet four others to diſcover. The middlemoſt and outermoſt, or third and fift *Sign. Caſſini* diſcovered in the years 1671,72 and 73, an account whereof is to be ſeen at large in Number 92 of theſe Tranſactions; the two innermoſt were reſerved to this preſent time for the ſame Obſerver, having now lately gotten yet better *Teleſcopes.* The account he gives of theſe Diſcoverys is as follows.

The Diſtance and Period of the firſt Satellite.

The firſt or innermoſt *Satellite* of *Saturn*, by the Obſervations hitherto made, is never diſtant from his Ring, above two thirds of the apparent length of the ſame Ring, which we take for the meaſure of the diſtances of theſe *Satellites*: and it makes one Revolution about him, in one day, 21 hours and 19 minutes. Wherefore in leſs than two days it makes two Conjunctions with *Saturn*, the one in the upper part of his Orbe, and the other in the lower part; and the Ring taking up the greateſt part of the *Diameter* of the *Circle*, wherein this *Satellite* makes its Revolution, theſe Conjunctions are of a long continuance, in reſpect of the whole Revolution, it being 8 hours and half in paſſing the length of the Ring, which at preſent hides it every day for ſo long time; and longer too, becauſe it is very hard to be diſtinguiſhed, when it is very near the Ring.

This happens particularly for theſe two or three years, when the Poſition of the Ring, in reſpect of the Earth, being very Oblique, it appears very narrow; and the *Circle* of this *Satellits Orb* being nearly in the ſame plain with it, they appear very cloſe together. In the following years when the Ring and the *Orbs* of theſe *Satellites* ſhall be more open, there will be a greater diſtance in *Latitude* between this *Satellite* and the Ring, and it may be ſeen both above and below the *Anſæ*, which at preſent cannot be.

Theſe Conjunctions of ſo long duration hapning often at the times moſt proper to obſerve *Saturn*, have frequently hindred the ſeeing of this *Satellite*; and particularly before we had found the Rules of its Motion, ſo as to be able to prepare to obſerve it, at the times when it was far from its Conjunction. And ſeeing one Conjunction begins 14 hours after another is finiſhed, and that each laſts 8 hours and half; whenever we hapned to obſerve after the beginning of a Conjunction, and continued the following days to obſerve about the ſame hour, there would be 9 or 10 days wherein this *Satellite* could not at all be ſeen, for this only reaſon : and if the courſe of the Obſervation were interrupted by ill Weather or any other cauſe, it has been above 20 or 22 days before it could be ſeen again : So it hapned ſoon after the firſt diſcovery thereof, the which has for this cauſe been incomparably more difficult to make, than any other hitherto made.

The Diſtance and Period of the ſecond Satellite.

The ſecond or penintime *Satellite* of *Saturn*, according to the Obſervations hitherto made, is but three quarters of the length of his Ring diſtant therefrom, and makes his Revolution about him in 2 days, 17 hours and 43 minutes.

There ſeldome paſſes a day wherein it is not joyned to *Saturn*, either in the upper or lower part of its *Orb*. The Conjunctions or times wherein it paſſes the whole length of the Ring, laſt 8 hours ; and 25 hours after one ends another begins. By reaſon that at firſt it could not be diſtinguiſhed, when it was not at a good diſtance from the Ring, and before we had found out the Rules of its Motion, to foreſee the times proper to obſerve it, we were ſeveral days without ſeeing it. Afterwards it was diſcovered one day to the *Eaſtward*, the next day to the *Weſtward*, and the third or fourth day at the ſame hour, it was again in Conjunction with *Saturn* : and ſo becauſe the firſt for ſeveral days together could not be ſeen at the ſame hour, it often hapned that neither the one nor the other was Viſible, and when one began to appear, it was uncertain which of the two it was, both of them ſhewing themſelves alternately one day on the *Eaſt* ſide, and the next day on the *Weſt* ſide.

This diſtinction was ſtill more difficult, for that the difference of their Elongations is ſo little, that for the moſt part the ſecond *Satellite* is found within the limits of the Elongations of the firſt, which likewiſe made it hard to determine their Degreſſions. It was not without a great number of choiſe Obſervations, that it was concluded that the proportion of the digreſſion of the ſecond, to that of the firſt, counting both from the Center of *Saturn*, is as 22 to 17.

The Rule of the Proportion, that is between the Diſtances and the times of their Periods.

The time wherein the ſecond *Satellite* makes its Revolution, is to the time wherein the firſt makes its, is as 24¾ to 17, which is a greater Proportion by half a Degree than that of the Diſtances, *viz.* 22 to 17. This is that very ſame Proportion which *Kepler* obſerves, between the Diſtances & Periods of the primary *Planets*, and which we have found between the other *Satellites* of *Saturn*, upon our former diſcovery, and is verified in the *Satellites* of *Jupiter*. There is nothing that better ſhews the admirable Harmony of the particular Syſtemes, with the great Syſteme of the World.

The Number of the Conjunctions, of theſe Satellites *with* Saturn.

Of all the *Satellites* that are, there are no two ſo near placed to their primary *Planet*, as theſe two *Satellites* of *Saturn*, and which taken both together make ſo great a number of Conjunctions with their *Planet* in the ſame ſpace of time; for there are in all no leſs than 653 in a year, whereas the two firſt *Satellites* of *Jupiter* make, one with another, but 617; the firſt of *Saturn*'s, makes its Revolution in 3 hours longer time than the firſt of *Jupiters*, but *Saturns* ſecond has its Period 9 hours and half ſhorter than *Jupiters* ſecond *Satellite*.

The Glaſſes uſed to make theſe Diſcoveries.

The Diſtance of theſe two *Planets*, which is almoſt Infinite in reſpect of their Magnitude, had kept them yet much longer concealed, if we had not for this purpoſe made uſe of Glaſſes of extraordinary Force. They were firſt of all ſeen in *March Anno* 1684, by two excellent Object Glaſſes of 100 and 136 *feet*, and afterwards by two others of 90 and 70 *feet*, all made by Sigr. *Campani* and ſent from *Rome* to the Royal Obſervatory by the Kings order, after the diſcovery of the third and fift *Satellites*, which had been made by others of his Glaſſes of 47 and 34 *feet*. We made uſe of them without *Tubes*, by a more ſimple contrivance than thoſe propoſed either before or ſince. We have ſince ſeen all theſe *Satellites* with that of 34 *feet*, and continued to obſerve them with Glaſſes of Mr. *Borelli* of 40 and 70 *feet*, and by thoſe which Mr. *Artouquel* hath lately made, of 80, 155 and 220 *feet*. It was eaſy for us to ſee theſe two *Satellites* by theſe different ſorts of Glaſſes, after having found the Rules of their Motion, whereby we might with more particular attention look upon the places where they ought to be.

We placed theſe great Glaſſes ſometimes upon the Obſervatory, ſometimes upon great Maſts, ſometimes upon the Tower of Wood, which his Majeſty has cauſed to be brought for this purpoſe from *Marly*, upon the Terraſs of the Obſervatory. Laſtly we put them in a *Tube* raiſed upon a ſupport made like a Ladder with three leggs, which had all the ſucceſs we deſired.

After having diſtinguiſhed theſe 2 *Satellites* from the fixt Starrs, from the other *Satellites* of *Saturn*, and from each other, and found the periods of their Motion, we have eſtabliſhed *Epochæ* from Obſervations, as near as we could to the Conjunctions,

Radices or Epochæ of their Motions.

The firſt *Satellite* was obſerved 45 *degrees* diſtant from its Perigee, moving towards the *Weſt*, *March* 11*th* 1686 ſt. N. at 10 *h.* 40 *min.* at night, and returned to the ſame poſition on the 14*th* of *April* at the ſame *hour.*

The ſecond was 36 *degrees* diſtant from the Perigee to the *Weſt*, the 30*th* of March 1686 ſt. N. at 8 of the clock in the evening.

A Compariſon of the Revolutions of Saturns Satellites *with* Jupiters.

It were too much at this time, to give all we have obſerved of the other *Satellites*, but we cannot miſs comparing the Periods of the *Satellites* of *Saturn* with thoſe of *Jupiter*, after the following manner, by which it appears that the *Satellites* of *Saturn* in the ſame order, performe their Revolutions in leſs time, than thoſe of *Jupiter*, that anſwer to them, except the firſt, as may be ſeen in this Table.

	day	*hour*	*min.*
The firſt Satellite *of* Jupiter *revolves in*	1	18	29
The firſt Satellite *of* Saturn *in*	1	21	19
The ſecond of Saturn *in*	2	17	43
The ſecond of Jupiter *in*	3	13	19
The third of Saturn *in*	4	12	27
The third of Jupiter *in*	7	4	0
The fourth of Saturn *in*	15	23	15
The fourth of Jupiter *in*	16	18	5
The fift of Saturn *in*	79	21	0

Theſe are the particulars of the Diſcovery, whereby the admirable Analogy and Uniformity of the parts of the Univerſe are moſt evident, and the Infinite Wiſdome and Power of the Creator is demonſtrated to the Contemplative. In the Concluſion, the Diſcoverer conſiders that the Antient Aſtronomers, having tranſlated the Names of their Heroes among the Starrs, thoſe Names have continued down to us unchanged, notwithſtanding the endeavour of following Ages to alter them ; and that *Galileo*, after their Example, had honoured the Houſe of the *Medici* with the diſcovery of the *Satellites* of *Jupiter*, made by him under the Protection of *Coſmus* II ; which Starrs will be always known by the Name of *Sidera Medicea*. Wherefore he concludes that the *Satellites* of *Saturn*, being much more exalted and more difficult to diſcover, are not unworthy to bear the Name of *Louis le Grand*, under whoſe Reign and in whoſe Obſervatory the ſame have been detected, which therefore he calls *Sidera Lodoicea*, not doubting but to have perpetuated the Name of that King, by a Monument much more laſting than thoſe of Braſs and Marble, which ſhall be erected to his Memory.

In our Figure we have omitted the Orbe of the outer *Satellite*, that ſo the reſt might not be crouded, but its diſtance to that of *Hugenius*'s, is as Cube Root of 25 or 2,925 to 1.

Two Aſtronomical Obſervations of the Eclipſes of the Planet Jupiter, *by the* Moon *in* March *and* April *laſt, made at* London.

The *Lipſick Ephemerides* of Mr. *Godfrid Kirck*, giving notice of theſe Occultations, they were thought of too great conſequence to be neglected, if the weather proved fair. The firſt hapned *March* 31*th*. at night, and was attended with a moſt Serene Sky, no Clouds any where appearing, wherefore Mr. *Hook* and *E. Halley* undertook the Obſervation in *Greſham*